

EETF Quarterly Progress Report

Grant # 7310029

Safe and Efficient Exhaust Thimble

Submitted by:

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Period: July 1, 2014 – Sept. 30, 2014 (Q3)

Summary

The project Budget/Milestone Schedule from the Grantee's original scope of work is shown below. No changes to this scope have been made or requested. An initial 6-month no-cost extension was granted with a revised end date of June 30, 2014. A second no-cost extension was granted in May 2014 to permit additional cold-weather testing to be done in Fall 2014. The new end date is June 30, 2015.

Milestone	Task	Start Date	End Date	Grant Funds	Match Funds	Total Budget	Deliverables
1	Purchase and assembly of DAQ and instrumentation	Feb 2013	Feb 2013	\$12,196		\$12,196	DAQ system "dry-run" data set to ACEP for plan verification
2	High fidelity performance test of 2-inch thimble	Mar 2013	Mar 2013	\$11,193	\$5793	\$16,986	Performance test results
MS 1: AEA accepts performance test results							
3	Design, construct and testing of 4, 6, 8, and 10-inch thimbles	Apr 2013	Oct 2013	\$62,868		\$62,868	Performance test results
4	Draft project report	Nov 2013	Dec 2013	\$816		\$816	Draft project report
5	Final project report	Dec 2013	Jan 2014	\$816		\$816	Final project report
MS 2: AEA accepts final report							
Total				\$87889	\$5793	\$93,682	

Deliverables Submitted

Task 1 and task 2 are complete. Work continued this review period on the obstruction testing for task 3. The remaining tasks are cold-weather testing of all thimble sizes.

Budget

Total funds expended to date are \$42,395.37 of the grant total \$87,889.00 (~48%). With the remaining cold weather tests and report writing anticipated to not require significant more labor, the project will likely end under budget. Overall spending is currently below budget.

Schedule Status

Tasks 1 and 2 are complete, and Task 3 is approximately 85% complete. All four thimbles in task 3 have been constructed and tested a minimum of 4 non-consecutive times at 4 different exhaust temperatures. Obstruction testing and wind effect testing has been completed on all thimble sizes in warm weather. The project is currently waiting for colder winter temperatures to complete the cold weather testing. It is anticipated that there may be minimal to no work in Q4, depending on the late winter weather. If that happens, completion of the testing will occur in Q1 of 2015.

Percent Complete

The estimated percent completion of the 5 project tasks is shown in the table below.

Task 1: 100%	Task 2: 100%	Task 3: 85%	Task 4: 75%	Task 5: 0%
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Task 1, *Purchase and assembly of DAQ and instrumentation*, is complete. This task was under budget because several pieces of equipment were obtained through surplus from previous university projects. This includes the data collection computer, A/D hardware box from National Instruments, and several non-grounded thermocouples. The pitot tube acquired in Q4 2013 was still not able to record reliably at higher temperatures, and so a pinwheel anemometer was purchased in Q1 2014. This does appear to be recorded consistently and reasonably accurately.

Task 2, *High fidelity performance test of thimble*, is complete. Reproducible temperature data are being collected from 9 different locations on the thimble, and repeat measurements are made non-consecutively in order to avoid systematic errors. The new pinwheel anemometer is able to measure air flow through the cooling channel with reproducible results.

Task 3, *Design and Construction of Four New Thimbles*, is approximately 85% complete. All four of the thimbles have been constructed and tested at least four different times. Temperature data are recorded at the 9 key locations, and air flow is measured in at one location in the cooling channel. Obstruction testing of all sizes has been conducted. The effect of wind has been tested on all thimble sizes using a large industrial fan.

Work Progress

The work completed in this quarter was obstruction testing, and wind testing. In obstruction testing, non-combustible material was added to the annular region of the thimble to obstruct the natural convection, and a steady-state performance test was completed. The annular space was occluded 1/3, 2/3, and 3/3, for three obstruction tests for each thimble, and at each of the temperatures. The overall result is that the thimble performs nearly identical with 1/3, shows slight increase in temperature at 2/3, and a dramatic increase in the exit air temperature at complete occlusion. With the annular area completely obstructed, the "exit" air temperature is not really the exiting air, but rather the stagnant air at the exit.

The effect of wind on the performance was tested by placing a large, industrial ventilation fan outside the connex on the roof, and aiming it directly at the thimble. Although this was not anticipated to have an effect on the performance since it should not effect the thermal chimney effect occurring inside the thimble, it could seem plausible that some Bernoulli effects could cause uneven air flow near the exit of the thimble. Fan tests were run for all 4 thimble sizes, and at all exhaust temperatures. Results of the tests showed negligible effect when the fan was on versus when it was not.

Future Work

Complete remaining Task 3 item: cold weather testing.